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10/507,325	09/10/2004	Hideki Morita	APA-0216	2850

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Cheng Law Group, PLLC
1100 17th Street, N.W.
Suite 503
Washington, DC 20036

EXAMINER	
LAZORCIK, JASON L	
ART UNIT	PAPER NUMBER
1791	

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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/507,325	MORITA ET AL.	
	Examiner	Art Unit	
	JASON L. LAZORCIK	1791	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *04 February 2009*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-5* is/are pending in the application.

4a) Of the above claim(s) *5* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-4* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on February 4, 2009 has been entered.

Status of the Claims

Applicants reply dated February 4, 2009 amends independent claim 1 and cancels claim 6. All other claims stand as previously presented in the reply dated April 25, 2008.

Claims 1-5 are pending in the Application

Claim 6 stands as having been cancelled by Applicant

Claim 5 has been withdrawn from consideration for being drawn to a non-elected invention

Therefore, Claims 1-4 are currently pending for prosecution on the merits.

Preliminary Notice

Upon further consideration of the mathematical derivation of formula (5) as presented in the Specification pages 5-6, it is the Examiners assessment that the calculation appears to be flawed. Specifically, it is the Examiners understanding that the value A is representative of the dimensionless value for the amount of light absorbed in the sample S (see page 5, lines 20-21; page 7, lines 1-2; page 13, lines 28-29) and that the value B represents the dimensionless fractional amount of light absorbed in the brittle material W of thickness D (see particularly page 6, line 16; page 13, lines 27-28), where the brittle material W is the same material as sample S. Now in Equation (2), Applicant derives the following formula for the wherein;

$$I/Io = (100-A)/100 = \exp(-\alpha\, d)$$

However in the analogous equation derived for the brittle material W, Applicant arrives at the following:

$$I'/Io = B/100 = \exp(-\alpha\, D)$$

It is not evident to the Examiner precisely why or how Applicant arrives at two different results for essentially the identical same calculation. Further, it would appear that Applicant carries this error through to the ultimate derivation of Equation (5). In the event that the Examiner has misinterpreted Applicants derivation of Equation (5), Applicant is respectfully requested to clarify the nature of the derivation.

Claim Rejections - 35 USC § 112

2. The following is a quotation of the first paragraph of 35 U.S.C. 112:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

3. **Claims 1-5 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement**. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention.

4. Amended Claim 1, line 23 recites the limitation wherein "a predetermined transmittance (B)" is employed in the calculation according to Formula 1. An examination of the Specification as originally filed does not appear to support the present claim limitation. Specifically, page 6, lines 16-21 recite in pertinent part that "if a percentage B% is determined as the absorptance, the absorptance that this corresponds to can be calculated based on the equation (5) given above". Further, there is no indication that the originally filed specification that a transmittance value is "predetermined" in the manner presently recited.

5. Amended claim 1, line 25 recites the limitation the light source emits light having the optimum wavelength such that "the actual absorptance of the plate-shaped sample is near the calculated absorptance (A)". Applicants Specification as originally filed does not provide guidance nor support for the range encompassed by the term "near the calculated absorptance (A)" and one of ordinary skill in the art would not have been apprised of such a limitation in view of the originally filed Specification.

6. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

7. Claims 1-5 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

8. Amended Claim 1, line 6 recites the limitation of “the absorptance of a brittle material”. There is insufficient antecedent basis for this limitation in the claim.

9. Claim 1, lines 4-5 recite the limitation of "a set value of absorptance" while line 23 recites the limitation wherein the absorptance of the plate shaped sample is calculated based upon “a predetermined transmittance (B)" according to the formula.

10. Claim 1, line 3 recites the step of “irradiating a light onto a plate-shaped sample with a plurality of wavelengths” and Claim 1, lines 7-8 recite the limitation of “actual absorptance data obtained from the irradiation of light onto the plate-shaped sample”. It is note evident that any definitive nexus exists between the step if irradiating the light and the “actual absorbance data obtained from the irradiation step. That is, there is no clear step of gathering, measuring, or recording of the data which would link the irradiation with the actual absorptance data.

11. The term "near" in claim 1, line 25 is a relative term which renders the claim indefinite. The term "near" is not defined by the claim, the specification does not provide a standard for ascertaining the requisite degree, and one of ordinary skill in the art would not be reasonably apprised of the scope of the invention. .

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

The factual inquiries set forth in *Graham* **v.** *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

Claims 1-4 are rejected under 35 U.S.C. 103(a) as being unpatentable over Smart (US 6,337,462 B1).

Smart broadly teaches a system and method used for processing a brittle material, such as silicon, by illuminating said brittle material with light of an optimized wavelength.

(I) Smart is silent regarding the step of irradiating a sample

Smart presents data in figure 1 which details the absorption coefficient as a function of wavelength wherein said data was obtained upon a sample of the same brittle material intended for the processing steps. Smart is silent regarding the step of

"irradiating a light onto a plate-shaped sample with a plurality of wavelength" as recited in claim 1, line 2

(II) Irradiation of the plate shaped sample is obvious over Smart and the ordinary level of skill in the art at the time of the invention.

Although the Smart reference is silent regarding the method employed to obtain this data set, it is the Examiners position that said data was either implicitly obtained by irradiating a light with a plurality of wavelengths onto a sample of the brittle material, or alternately that such a measurement would have represented a merely trivial extension over the Smart teachings for one of ordinary skill in the art at the time of the invention.

Specifically, one of ordinary skill would recognize the data presented in figure 1 as corresponding to a conventional absorptance data in the near-IR wavelength range. Applicants claimed method of acquiring such a spectrogram, namely by irradiating light having a plurality of wavelengths onto a “plate-shaped” sample would be recognized as merely routine and conventional to a skilled artisan. Similarly a skilled practitioners would be apprised of the established mathematical correlation between absorbance, irradiation intensity, absorption coefficient, and the sample thickness commonly referenced as the Beer-Lambert law. Conventional spectrometers measure light intensity (e.g. absorptance or transmittance) as a function of wavelength, and it follows in view of the Beer-Lambert law that the figure 1 plot of absorption coefficient versus wavelength must therefore account for the sample thickness.

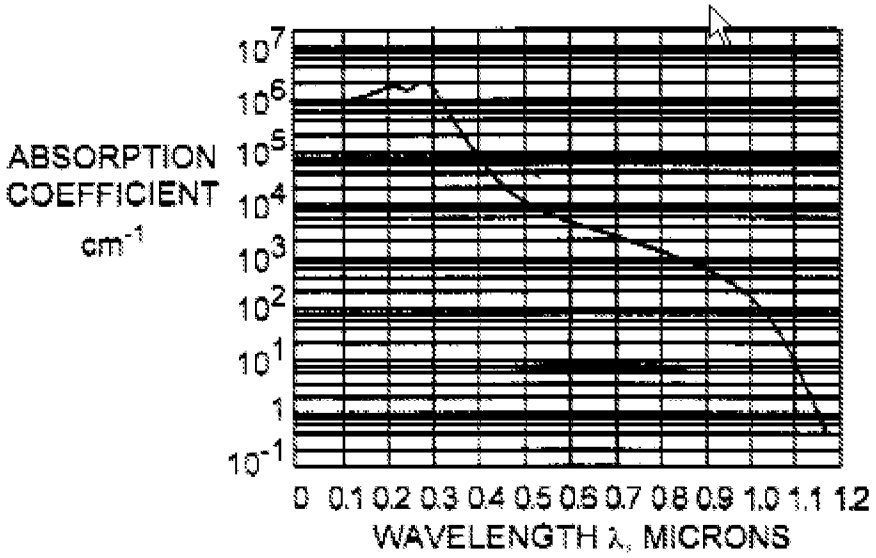

FIG. 1

In short, the data presented by Smart in figure 1 imply the execution of Applicants claimed steps of

1) irradiating a light onto a plate-shaped sample with a plurality of wavelengths

Alternately, it is the Examiners position that such steps are merely conventional and would represent a trivial and routine measure for skilled practitioners in view of the Smart disclosure.

Next, Smart teaches (Column 5, line 63 to column 6, line 14) a value of absorptance of the plate shaped sample is calculated for incident radiation at wavelengths of 1.047 and 1.2 microns. This absorptance (I/Io) is calculated based upon a set value of absorptance (e.g. fig 1) and a thickness (x) of the plate-shaped sample. Specifically, the illumination wavelength is set or selected to be at a wavelength beyond

the absorption edge of about 1.1 microns (Column 2, Lines 10-12) in order to minimize thermal processing damage to the substrate.

In view of the calculated absorptance values (e.g. 86.5% at 1.047 microns versus 1% at 1.2 microns) and the actual absorptance data from figure 1, Smart determines that irradiation at 1.2 microns is an optimal wavelength for processing of the brittle material. This optimal wavelength for processing the brittle material is "set in advance" and it is the examiners position that during the processing, a light source with the optimal wavelength is at least partially absorbed by the sample and "serves as a heating source onto the brittle material". It is further noted that the sample is mounted upon a table (34) which serves as a "reflective layer" [**Claims 3, 4**] on the rear side of a light irradiating position and that the sample is repeatedly advanced into position along “a predetermined line”.

Smart discloses that the selected wavelength of light plays an important role in effectively processing the brittle substrate material without subjecting said brittle material to excessive heating and damage. Since Smart selects a wavelength for which the brittle material is largely transparent, it should appear evident that this optimum wavelength "permits a region of an internal material portion of the brittle material and the surface vicinity of the brittle material to become an absorbing region by the irradiation of the light onto the brittle material”.

As noted above, it is implicitly understood from the absorbance coefficient plot presented in figure 1 that the sample(s) of material used to generate said plot were

irradiated "in sequence" by at least one light source having a plurality of mutually exclusive wavelengths. Should Applicant argue that Smart nowhere explicitly stated that the sample data of figure 1 was acquired using a plurality of different sources having exclusive wavelengths, then it is the Examiners position that one of ordinary skill in the art would have been fully capable of obtaining the sample absorptance data by any conventional means available in the art at the time of the invention [**Claim 2**].

Restated, the preferred method of acquiring the sample absorptance data is not deemed particularly germane to the method of using said data to select an appropriate irradiation wavelength for the processing of the brittle material. It follows, absent any compelling evidence to the contrary, it would have been just as obvious to acquire individual absorptance data points for the sample material using, for example, a plurality of monochromatic sources (lasers) of mutually exclusive wavelengths as it would have been to utilize a single broadband source paired with a monochrometer. At the very least, it would have been obvious for one of ordinary skill in the art to try the plurality of light sources at the time of the invention.

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(III) Smart is silent regarding Applicants recited step for calculating the absorptance based upon Formula (I)

The Smart reference instructs (Column 5, line 63 – Column 6, line14) that the chosen wavelength affects the depth to which the incident radiation penetrates the substrate. In this passage, Smart lays out the particular relationship between

illumination depth, material absorbance, and wavelength which would have represented a significant concern to processing the buried features of particular concern in the reference (Column 8, lines 15-48). Further, Smart teaches that a minor change in the illumination wavelength results in a drastic change in absorption efficiency.

Smart is silent regarding the step of calculating the absorptance of the plate-shaped sample by Formula (I) and selecting a wavelength of light to make "the actual absorptance of the plate shaped sample" near to "the calculated absorptance"

(IV) Calculation of absorptance based upon the Formula (I) would have been obvious for one having an ordinary level of skill in the art at the time of the invention.

Now, with respect to the calculation of absorptance by Formula (I) as recited in amended claim 1, Applicant was previously advised that the mathematical relationship presented by the Beer-Lambert Law would be readily appreciated by one of ordinary skill in the art. Specifically, the Beer-Lambert Law;

$$T = \frac{I_1}{I_0} = 10^{-\alpha l} = 10^{-\varepsilon l c}$$

Teaches that Transmissivity (or Absorbance/100) is related to the absorption coefficient of the material (α) and the thickness of the material (l). Applicant derives Formula (I) from the well known Beer-Lambert Law in the bridging paragraphs between pages 5 and 6 of the Specification. Steps (1) through (3) of this derivation appear to be simple mathematical transforms of the basic Beer-Lambert Law as presented above. In Steps (4) and (5), applicant appears to merely derive the expected absorbance value of

a sample having a thickness d to a sample of the same material having a different thickness D. That is, Formula (5) from the Specification and its equivalent Formula (I) in the instant claims, constitutes no more than a mathematical relationship showing that the absorptance of a sample of material having a set thickness can be predicted based upon a known absorptance value of a piece of the same material having a different thickness

The fundamental Beer-Lambert Law equation and its present transforms would be viewed as elementary considerations for one of ordinary skill in the art. As Smart has shown above, the optimum wavelength is selected based upon the inherent transmission properties of the material being processed and upon the thickness of said material. One of ordinary skill would reasonably be expected to perform the instant calculations in order to insure that light of the optimum wavelength would penetrate to an effective depth in the brittle material.

Response to Arguments

Rejections Under 35 U.S.C. §103(a) over Smart (US 6,337,462)

Argument #1

Applicant alleges that Smart fails to teach or suggest all the claim limitations including, 1) The limitation wherein "the optimum wavelength of light permits a region of an internal material portion of the brittle material and the surface vicinity of the brittle

material to become an absorbing region by the irradiation of the light onto the brittle material"

2) The limitation wherein "the optimum wavelength of light allows for the generation of a uniform heating band in the thickness direction and the formation of cracks deep in the internal portion of the brittle material".

With respect to the first two arguments above Applicant alleges, in pertinent part, that the optimum wavelength *permits* (emphasis added) regions of surface and internal portions of the material to become absorbing regions and *allows* (emphasis added) a uniform heating band and formation of cracks. The act of permitting and/or allowing an act is not equivalent to a step of actually performing that act. That is permitting and allowing pertain to the potential to perform the act but in no manner require that the act is in any manner actually executed. Further, Applicant is advised that the claim language is employs open-ended "comprising" language and is therefore not exclusive of additional materials, acts or functions.

It follows that where the wavelength of irradiated light employed in the prior art examples does not explicitly prevent or exclude the outcomes recited in the instant claim, then said wavelength would rightly be construed, in the broadest reasonable construction of the term, to *permit* a regions surface and internal portions of the material to become absorbing regions and to *allow* a uniform heating band and formation of cracks.

12. To the extent that Applicant implies the wavelength of light is actually absorbed by both internal and surface portions of the brittle material and that the wavelength of light actually generates a uniform heating band and cracks "deep in the internal portion of the material", such a limitation is nowhere recited in the pending claim language. In response to applicant's argument that the references fail to show certain features of applicant's invention, it is noted that the features upon which applicant relies are not recited in the rejected claim(s). Although the claims are interpreted in light of the specification, limitations from the specification are not read into the claims. See *In re Van Geuns*, 988 F.2d 1181, 26 USPQ2d 1057 (Fed. Cir. 1993).

In addition, Applicant acknowledges that Smart performs a calculation of the absorption for different wavelengths of light (see bridging paragraph pages 6-7) and acknowledges that Smart teaches selecting an optimal wavelength of light for substrate processing (first paragraph page 7). However applicant alleges that the present invention is distinguished in that the claimed invention permits a region of internal material and in the surface vicinity to become an absorbing region and that the inventive process allows generation of uniform heating band in the thickness direction and the formation of cracks in the internal portion of the material.

13. The above comments regarding permitting and allowing" notwithstanding, Applicants arguments fail to comply with 37 CFR 1.111(b) because they amount to a general allegation that the claims define a patentable invention without specifically pointing out how the language of the claims patentably distinguishes them from the

references. That is, Applicant has presented substantially no reasoned basis to suggest that the prior art disclosed process is in any manner patentably distinguishable from the claimed invention.

Applicants arguments directed to calculation of the absorptance of the plate shaped sample have been considered but are moot in view of the new grounds of rejection as presented above.

Further, Applicant has provided substantially no rebuttal to the Examiners stated position regarding the absorptance calculation as presented in the Official Action dated August 4, 2008. Specifically, Applicant was advised that the recited formula constitutes a simple transformation of the well known Beer-Lambert equations and that calculation of predicted absorbance based upon the material absorbency and sample thickness would constitute a conventional matter for a skilled artisan. Specifically, Applicant was advised that Smart demonstrates that an optimum wavelength is selected based upon the inherent transmission properties of the material being processed and upon the thickness of said material. One of ordinary skill would reasonably be expected to perform the instant calculations in order to insure that light of the optimum wavelength would penetrate to an effective depth in the brittle material.

Applicant has failed to present a cogent rebuttal to the Examiners stated position on this matter.

Conclusion

14. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. The United States patent to Drummond et. al. (US 6,841,024) underscores the Examiners position regarding the conventional nature of the Beer Lambert law for light transmission through a workpiece (Col. 1, lines 54-64). The United States Pre-Grant Publication to Kwan (US 2004/0150688) similarly teaches (see particularly ¶[0006-0008] that use of the Beer Lambert law to predict laser light transmission through a workpiece is a routine task and specifically states that the “ability to predict or otherwise identify a laser light transmissivity characteristic of a work piece before the piece undergoes" work by the laser is a recognized process variable deemed conventional to those skilled in the arts. Finally, the reference to Ihlemann et al (Appl. Phys. A 54, 363-368 (1992)) teaches that it is known to optimize the wavelength of light used to process a given brittle substrate material.

As referenced in the previous Official Action, Lapham (US 4,399,345) teaches selective processing of brittle substrates by optimization and tuning of the irradiation wavelength and is understood to apply under 35 U.S.C. 102(b)/103(a) according to similar arguments presented above for the Smart (US 6,337,462 B1) reference. Leong et. al. (US 5,611,946) present a multi-wavelength laser cutter system for processing brittle substrates similar to Smart and Lepham. Any reply to the instant Official Action should carefully consider the scope and content of each of these disclosures.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to JASON L. LAZORCIK whose telephone number is

(571)272-2217. The examiner can normally be reached on Monday through Friday 8:30 am to 5:00pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Steven Griffin can be reached on (571) 272-1189. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Steven P. Griffin/
Supervisory Patent Examiner, Art Unit 1791

/J. L. L./
Examiner, Art Unit 1791
15.